P3 Waves, Light and Sound

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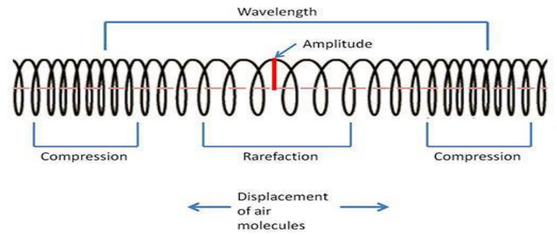
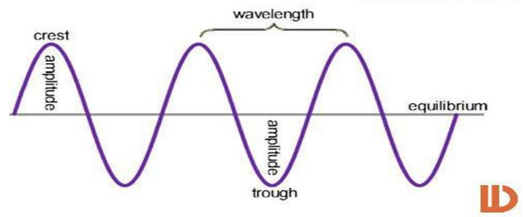
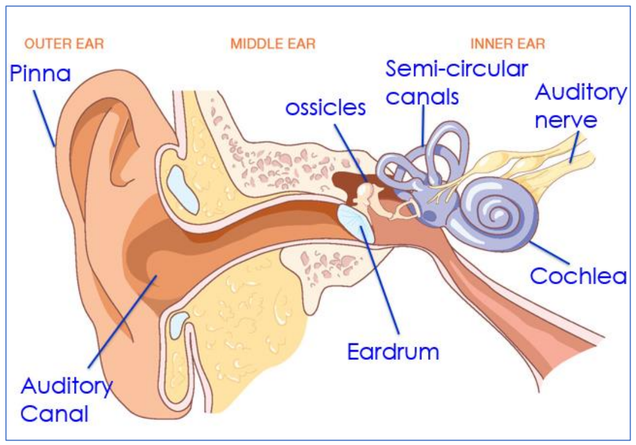
Keyword	Definition
Transverse	In physics, a transverse wave is a wave whose oscillations are perpendicular to the direction of the wave's advance
Oscillations	Regular movements back and forth.
Wavelength	the distance between successive crests of a wave
Amplitude	the maximum extent of a vibration or oscillation, measured from the position of equilibrium.
Frequency	the rate per second of a vibration constituting a wave, either in a material (as in sound waves), or in an electromagnetic field (as in radio waves and light).
Parallel	(of lines, planes, or surfaces) side by side and having the same distance continuously between them.
Perpendicular	at an angle of 90° to a given line, plane, or surface or to the ground.
Luminous	giving off light
Opaque	not able to be seen through; not transparent.
Translucent	(of a substance) allowing light, but not detailed shapes, to pass through; semi-transparent
Transparent	allowing light to pass through so that objects behind can be distinctly seen
Absorption	the process by which one thing absorbs or is absorbed by another.
Refraction	When a wave changes speed, which can cause it to change direction.
Spectrum	A series of similar waves arranged in order of wavelength or frequency.
Photosensitive	having a chemical, electrical, or other response to light.
Trough	Lowest point of a wave
Peak	Highest point of a wave

Longitudinal Waves
In longitudinal waves, the vibrations are parallel to the direction of the energy transfer.
Examples are: Sound Waves, Ultrasound Waves, Seismic, P-Waves.

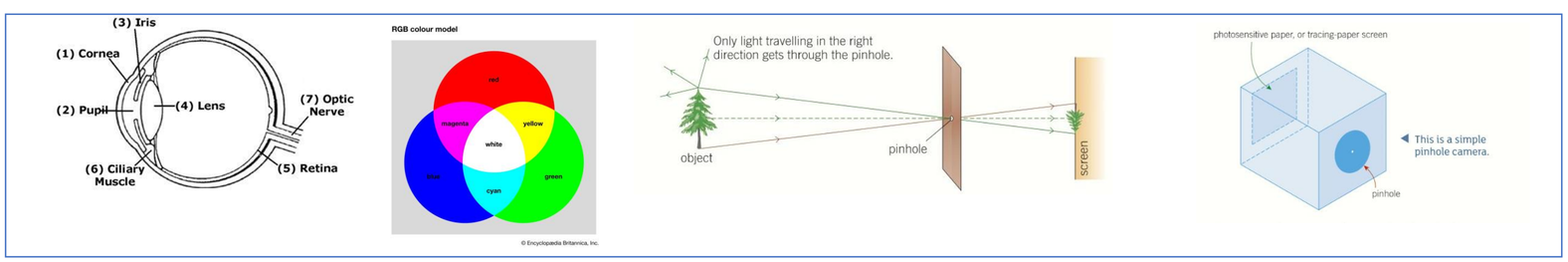


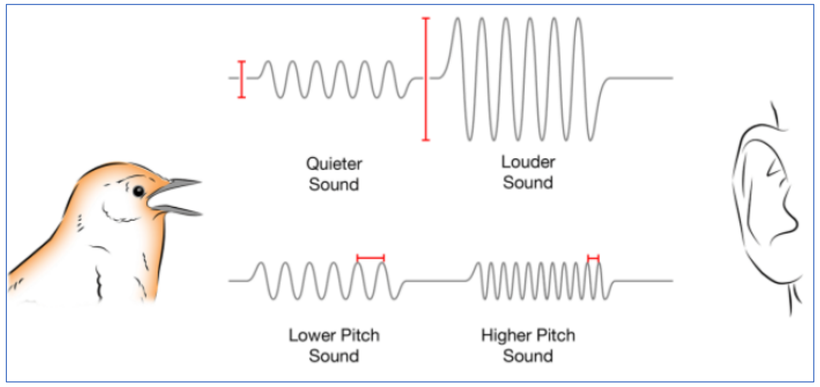
Transverse Waves
In transverse waves, the vibrations are at right angles to the direction of energy transfer.
Examples include: Ripples on water, vibrations on a guitar string and a Mexican Wave. Electromagnetic waves such as light waves, micro waves and radio waves.



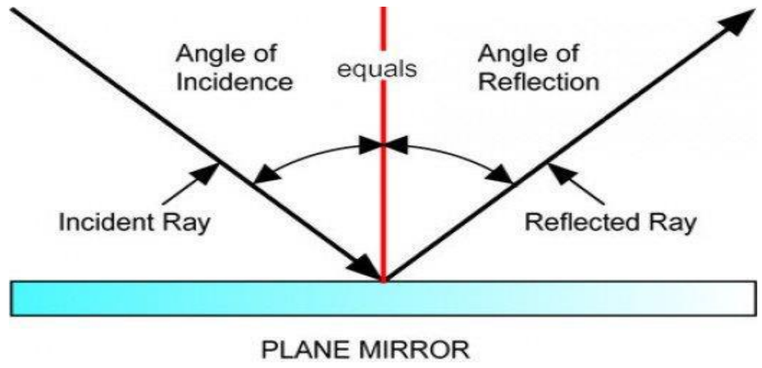


Further Reading:
https://www.bbc.co.uk/bitesize/topics/zw982hv

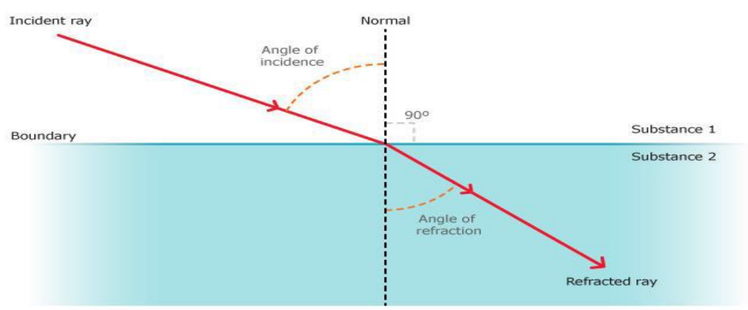




Reflection

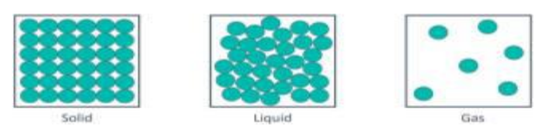


Refraction



Speed of Light 300,000km/s
Speed of Sound (air) 343m/s

Light can travel through a vacuum but sound cannot. Sound needs a medium to travel through either a solid, liquid or gas. Sound travels fastest in a solid because the particles are closer together.



P4 Electricity, Space and Forces

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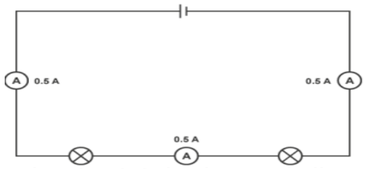
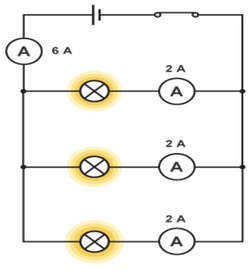
Keyword	Definition
Ammeter	A device used to measure electric current.
Ampere	Unit of current. E.g. The current in the bulb is 4 amps or amperes (A).
Cell	A store of chemical energy that can be transferred as an electric current in a circuit.
Conductor	A material which allows electrons or heat to move easily through it.
Electron	Sub atomic particle which flows in a circuit carrying a negative charge.
Series Circuit	A circuit connected in a way that the same current flows through each component in turn.
Parallel Circuit	In a parallel circuit, the current divides into two or more paths before recombining to complete the circuit
Insulator	A material that does not allow electrons or heat to pass through it easily.
Ohms	The unit of electrical resistance. Unit is Ω
Resistance	The opposition in an electrical component to the movement of electrical charge through it. Resistance is measured in ohms.
Potential Difference	The potential difference (or voltage) of a supply is a measure of the energy given to the charge carries in a circuit.
Volt	Unit of voltage. E.g. the voltage across the lamp was 6 volts (V).
Voltmeter	A device used to measure potential difference or voltage.

Series Circuit

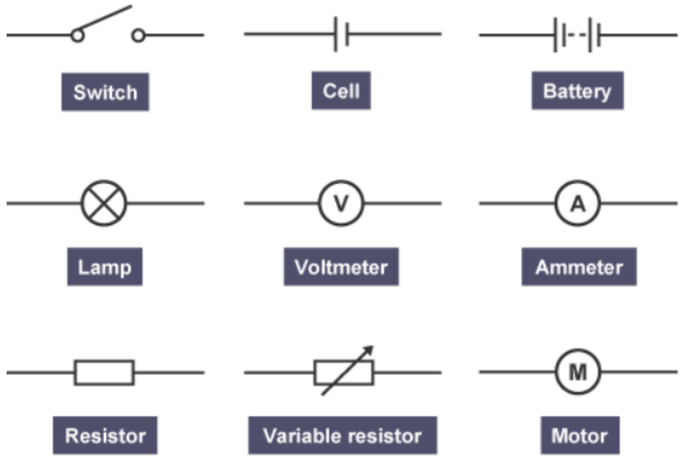


In series circuits:
- You get several components one after another.
- If a component breaks, the circuit is broken and all the other components stop working.
- The current is the same everywhere in a series circuit no matter where you put the ammeter –it will give the same reading.

Parallel Circuit



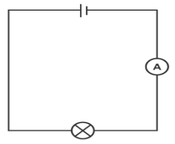
In parallel circuits:
- Different components are connected on different branches.
- If a component breaks, the components on the different branches keep working.
- Unlike series, the lamps stay bright If you add more lamps in parallel.
- Current is shared between the components.



Electric charge

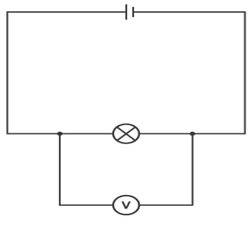
Some particles carry an electric charge. In electric wires these particles are called electrons. An electric current is a flow of charge, and in a wire this will be a flow of electrons. For an electric current to flow we need:
- Something to transfer the energy to the electrons, such as a cell, battery or power pack.
- A complete path for the electrons to flow through (a complete circuit).

Current



Current is measured in amperes (A). 20A is a bigger current that 10A. An ammeter is used to measure the current. The ammeter must be connected in series.

Potential Difference



Potential difference is a measure of the difference in energy between two parts of a circuit. The bigger the difference in energy, the bigger the potential difference.
Potential difference is measured in volts. A 230V is a bigger potential difference than 12V.
A voltmeter is used to measure the potential difference, and must be in parallel.

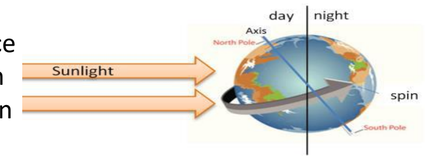
Resistance

The wires and other components in a circuit reduce the flow of charge through them –this is resistance.
The resistance increases when you add more components in series.

Keyword	Definition
Gravity	The force of attraction between all objects. The more mass an object has, the larger the force of gravity it exerts.
Mass	Amount of matter there is in something. Measured in kilograms, kg.
Orbit	An orbit is the path that an object takes in space when it goes around a star, a planet, or a moon.
Season	One of four times of the year (winter, spring, summer or autumn).
Solar System	A solar system consists of a Sun, with planets and smaller objects such as asteroids and comets in orbit around it.
Star	A large mass at the centre of a Solar System (if there are other bodies present) that produces heat and light, e.g. the star at the centre of our Solar System is called the Sun.
Weight	The force of gravity on an object. Measured in newtons, N.

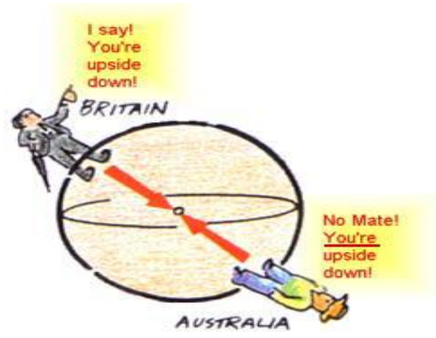
Day and Night

The Earth rotates (spins) round on its axis once in 24hrs. We spin into the light (day) and then back out again (night) The Earth orbits the Sun once every 365 days .



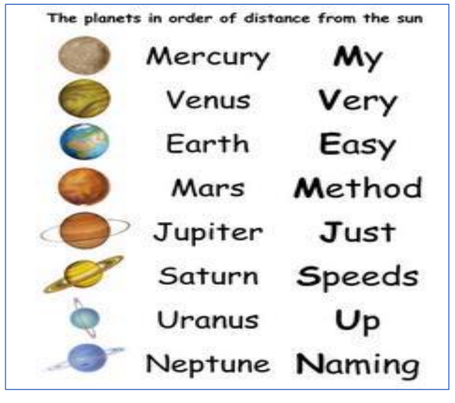
Gravity

The planets are held in their orbits by the force of the Sun's gravity. The Moon is held in its orbit round the Earth by the Earth's gravity.
The Sun's gravity also holds dwarf planets and asteroids in their orbits. Comets orbit the Sun too. The Suns gravity pulls them in from beyond the orbit of Pluto. The closer they get to the Sun the stronger the force of gravity gets and the faster they go.
Gravity always pulls things towards the centre of the mass making the gravity. So on Earth it pulls down to the centre of the Earth.



Weight and Mass

Mass is the amount of matter there is in something. It is measured in kilograms, kg. An objects mass the same everywhere in the universe.
Weight is the force of gravity on an object. All forces including weight are measured in Newtons, N. Gravity is not the same everywhere. So, an object's weight depends on where in the universe it is.
To work out the weight of an object we do some Maths. Weight (N) = mass (kg) x gravitational field strength (N/kg)



P4 Electricity, Circuits and Forces

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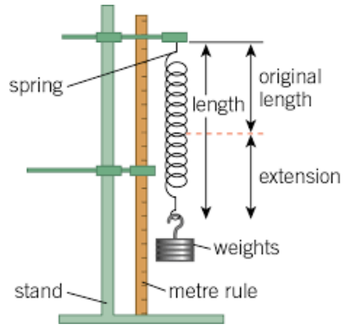
Hooke's Law Practical

Aim: To investigate how adding mass to a spring affects the springs extension.

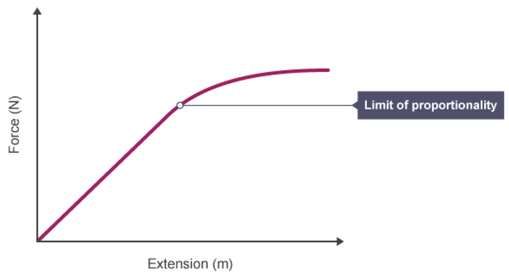


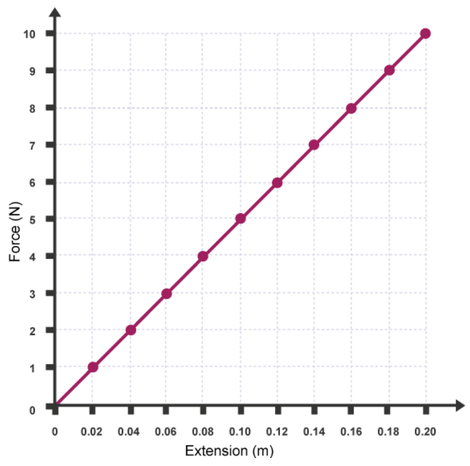
Method:
1.Set up the equipment as shown in the diagram.
2.Add 10g mass to the holder and record the spring length.
3.Add another 10g and record the new spring length.
4.Take away the previous spring length from the new length to calculate extension.
5.Repeat by adding 100g masses until 100g is reached.

Independent Variable: Mass added (g)
Dependent Variable: Extension (mm/cm)
Controlled Variable: Spring and Slotted Mass

Mass used	Force	Spring length	Extension
0 g	0 N	20 mm	20 mm
10 g	0.1 N	25 mm	5 mm (25 - 20 = 5)
20 g	0.2 N	30 mm	5 mm
30 g	0.3 N	35 mm	5 mm
40 g	0.4 N	40 mm	5 mm
50 g	0.5 N	46 mm	5 mm

The extension of an elastic object, such as a spring, is directly proportional to the force applied, provided that The limit of proportionality is not exceeded.

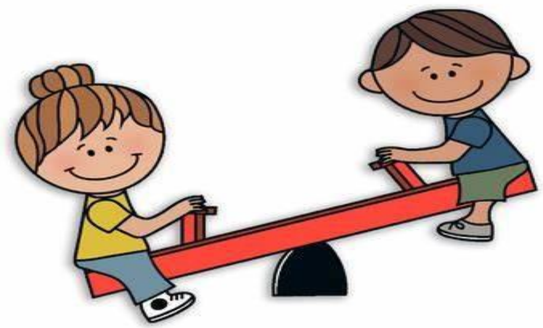




Further Reading:
https://www.bbc.co.uk/bitesize/topics/zgy39j6
https://www.bbc.co.uk/bitesize/topics/z8c9q6f
https://www.bbc.co.uk/bitesize/topics/z4brd2p/articles/z96g3j6
https://www.bbc.co.uk/bitesize/topics/z4brd2p/articles/zv4jdp3

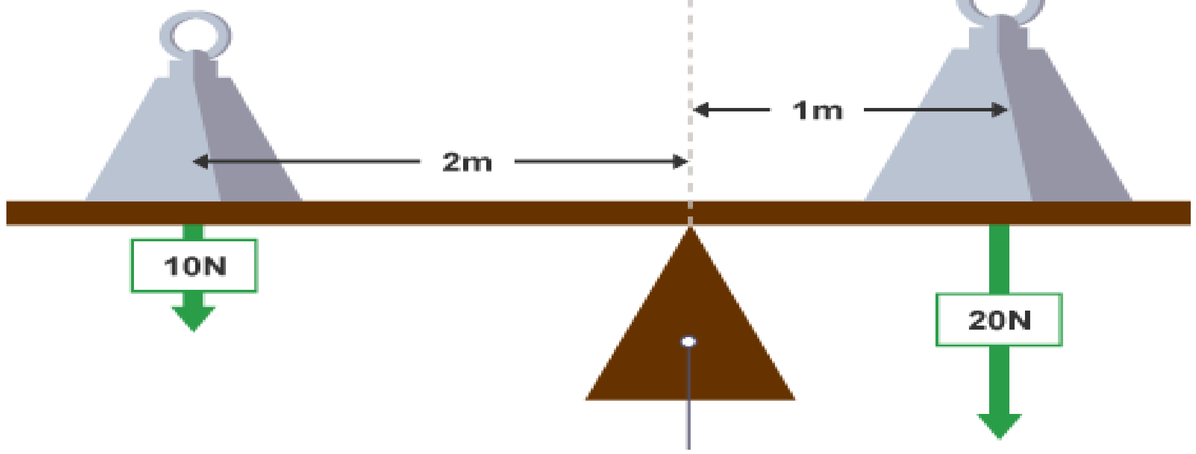
Moments:

A moment is a turning effect of a force. Forces can make objects turn if there is a pivot.



Think of a see-saw in a playground. The pivot is the part in the middle. The see saw is level when no one is on it, but tips if someone gets on one of the ends. It is possible to balance the see saw again if someone else gets on to the other end and sits in the correct place. This is because the turning forces are balanced.

To calculate moments, you need two things: The distance from the pivot that the force is applied and the size of the force applied.
moment (Nm) = force (N) x distance (m)



Moment on the left:
moment = force (N) x distance (m)
moment = 10N x 2
Moment = 20Nm

Moment on the right:
moment = force (N) x distance (m)
moment = 20N x 1
Moment = 20Nm

Notice that the two moments in the example above are equal and opposite. They are both 20Nm but the left are acting in an anti-clockwise direction, whilst the right side is acting in a clockwise direction.

This is why the beam is balanced.